Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 10 *Swine Day (1968-2014)*

Article 1244

2012

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Abstract

A total of 288 pigs (PIC 327 Ã— 1050, initially 109.3 lb BW) were used in an 81-d trial to determine the effects of diet form and fiber (from dried distillers grains with solubles [DDGS] and wheat middlings) withdrawal before harvest on growth performance of growing-finishing pigs. Treatments were arranged in a 2 Ã— 3 factorial with the main effects of diet form and dietary fiber feeding regimen. The 2 diet forms were meal or pellet. The 3 fiber feeding regimens were (1) low dietary fiber (corn-soybean mealâ€"based diets) from d 0 to 81, (2) high dietary fiber (30% DDGS and 19% wheat midds) from d 0 to 64 followed by low fiber from d 64 to 81 (fiber withdrawal), and (3) high dietary fiber from d 0 to 81.; Swine Day, Manhattan, KS, November 15, 2012

Keywords

Kansas Agricultural Experiment Station contribution; no. 13-026-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 1074; Swine; DDGS; Diet form; Pellet; Finishing pig; Wheat middlings

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Effects of Diet Form and Fiber Withdrawal Before Marketing on Growth Performance of Growing-Finishing Pigs[1,2]

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Summary

A total of 288 pigs (PIC 327 × 1050, initially 109.3 lb BW) were used in an 81-d trial to determine the effects of diet form and fiber (from dried distillers grains with solubles [DDGS] and wheat middlings) withdrawal before harvest on growth performance of growing-finishing pigs. Treatments were arranged in a 2 × 3 factorial with the main effects of diet form and dietary fiber feeding regimen. The 2 diet forms were meal or pellet. The 3 fiber feeding regimens were (1) low dietary fiber (corn-soybean meal–based diets) from d 0 to 81, (2) high dietary fiber (30% DDGS and 19% wheat midds) from d 0 to 64 followed by low fiber from d 64 to 81 (fiber withdrawal), and (3) high dietary fiber from d 0 to 81.

No interactions ($P > 0.13$) were observed for growth performance between diet form and fiber withdrawal regimens. From d 0 to 64, there were no differences ($P > 0.27$) in ADG between pigs fed different diet forms. Pigs fed meal diets had increased ($P < 0.02$) ADFI and poorer ($P < 0.001$) F/G compared with pigs fed pelleted diets. Pigs fed pelleted diets tended ($P < 0.08$) to have increased final BW and HCW compared with pigs fed meal diets, but no difference ($P > 0.28$) was detected in carcass yield. From d 0 to 64, fiber level did not influence ADG ($P > 0.64$); however, pigs fed low-fiber diets had decreased ($P < 0.01$) ADFI and improved ($P < 0.001$) F/G compared with pigs fed high-fiber diets. From d 64 to 81, pigs fed pelleted diets had increased $P < 0.005$) ADG and tended to have increased ($P < 0.10$) ADFI and better F/G ($P < 0.06$) than pigs fed meal diets. Pigs on the fiber withdrawal regimen had increased ($P < 0.03$) ADG compared with pigs kept on high-fiber diets; pigs previously fed the low-fiber diet were intermediate. Withdrawal of the high-fiber diet resulted in an increase ($P < 0.001$) in ADFI compared with pigs fed low-fiber or high-fiber diets throughout. Pigs fed low-fiber diets throughout the trial had improved ($P < 0.02$) F/G compared with pigs fed high-fiber diets throughout, and pigs on the withdrawal regimen were intermediate.

Overall (d 0 to 81), pigs fed pelleted diets had increased ($P < 0.03$) ADG and improved ($P < 0.001$) F/G compared with pigs fed meal, with no difference ($P > 0.12$) in ADFI. Fiber regimen did not influence ($P > 0.35$) ADG for the overall trial; however, pigs fed low fiber throughout the trial had decreased ($P < 0.001$) ADFI and improved ($P < 0.001$) F/G compared with pigs fed the withdrawal regimen or pigs fed high fiber

[1] Appreciation is expressed to Hubbard Feeds Inc. (Beloit, KS) for providing feed manufacturing services and to Clint Scheck for technical assistance.
[2] Appreciation is expressed to Farmland Foods (Crete, NE) for collecting carcass weights and fat samples and to Cory Rains and Roger Johnson for technical assistance.
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throughout. Fiber regimen did not affect ($P > 0.11$) final BW or HCW, but the fiber withdrawal regimen restored carcass yield to the low-fiber pigs, both of which were greater than those fed the high-fiber regimen ($P < 0.001$). For carcass fat quality, pigs fed pelleted diets had increased ($P < 0.001$) belly fat iodine value (IV) compared with pigs fed meal diets. Compared with pigs fed high fiber throughout the trial, pigs fed the low-fiber regimen had decreased ($P < 0.001$) IV, with those fed the withdrawal regimen intermediate. Compared with pigs fed low-fiber diets throughout, feeding high-fiber diets increased ADFI and resulted in poorer F/G, regardless of withdrawal. Withdrawing fiber allowed pigs to recover fully from losses in carcass yield, but only an intermediate improvement in belly fat IV was observed. Pelleting the diets improved ADG and F/G, but worsened belly fat IV, regardless of diet formulation; however, pelleting increased belly fat IV to a greater extent with the high-fiber diet containing DDGS and wheat midds than with the low fiber, corn-soybean meal diet.

Key words: DDGS, diet form, pellet, finishing pig, wheat middlings

Introduction

The inclusion of by-products as alternatives to corn and soybean meal in swine diets has greatly increased in recent years. Two common by-products that have been evaluated are DDGS and wheat midds. These are high-fiber ingredients that may provide a decrease in feed costs, but past research has demonstrated that high inclusion rates can also negatively affect growth performance, carcass yield, and carcass fat quality. One successful strategy to reduce these negative effects is withdrawing DDGS and wheat midds before harvest; however, the majority of these experiments have been conducted using meal diets. With increasing cost of cereal grains, more emphasis is being placed on improving feed efficiency by pelleting swine diets, but little information is available on the relationship between diet form and fiber feeding strategy. Therefore, the objective of this trial was to determine the effects of diet form and fiber withdrawal on growth performance, carcass yield, and carcass fat quality of growing-finishing pigs.

Procedures

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in this experiment. The study was conducted at the K-State Swine Teaching and Research Center in Manhattan, KS. The facility was a totally enclosed, environmentally regulated, mechanically ventilated barn containing 36 pens (8 ft × 10 ft). The pens had adjustable gates facing the alleyway and allowed 10 ft^2/pig. Each pen was equipped with a cup waterer and a single-sided, dry self-feeder (Farmweld, Teutopolis, IL) with 2 eating spaces located in the fence line. Pens were located over a completely slatted concrete floor with a 4-ft pit underneath for manure storage. The facility was also equipped with a computerized feeding system (FeedPro; Feedlogic Corp., Willmar, MN) that delivered and recorded diets as specified. The equipment provided pigs with ad libitum access to food and water.

A total of 288 pigs (PIC 327 × 1050, initially 109.3 lb BW) were used in an 81-d trial. Pens were randomly allotted to 1 of 6 experimental treatments by initial BW with 6 pens per treatment with 8 pigs per pen (4 barrows and 4 gilts per pen). Treatments were arranged in a 2 × 3 factorial with the main effects of diet form and dietary fiber feeding regimen. The 2 diet forms used were meal or pellet. The 3 fiber feeding regimens were (1) low dietary fiber (corn-soybean meal) from d 0 to 81, (2) high dietary fiber (30% DDGS and 19% wheat midds) from d 0 to 64 followed by low fiber from d 64 to 81 (fiber withdrawal), and (3) high dietary fiber from d 0 to 81 (Table 1). Diets were fed in 4 phases from d 0 to 14, d 15 to 40, d 40 to 64, and d 64 to 81, respectively. Pigs and feeders were weighed approximately every 2 wk to calculate ADG, ADFI, and F/G. Diets were prepared and pelleted at Hubbard Feeds in Beloit, KS. Pelleted feed was processed with a Sprout Waldron Pellet Mill, model Ace 501, equipped with a 11/64-in. diameter die. Diets were delivered in bulk and fed through bulk bins. Feed samples were taken at the feeder during each phase. Pellet durability index (PDI) was determined using the standard tumbling-box technique and modified PDI was done by adding 5 hexagonal nuts prior to tumbling. Percentage fines were also determined for all pelleted diets.

On d 81, all pigs were weighed individually, then transported to Farmland Foods (Crete, NE). Pigs were individually tattooed in sequential order by pen to allow for carcass data collection at the packing plant and data retrieval by pen. Hot carcass weights were measured immediately after evisceration and were used to calculate percentage yield by dividing HCW at the plant by live weight at the farm before transport. Fat samples were collected from the ventral side of the belly along the navel edge of each pig and analyzed for fatty acid profiles and calculation of IV.

Experimental data were analyzed using analysis of variance as a 2 × 3 factorial with 2 diet forms and 3 fiber regimens and their interaction as fixed effects using the PROC MIXED procedure of SAS. Differences between treatments were determined using the PDIFF statement in SAS. Pen was the experimental unit for all data analysis. Results were considered significant at $P \leq 0.05$ and a trend at $P \leq 0.10$.

Results and Discussion

Pellet quality measurements. Pellet durability index was excellent, with standard PDI greater than 90% during all phases for pelleted diets (Table 2). Percentage fines were low for all diets and phases at less than 10% fines.

Growth performance and carcass weight. No diet form × fiber regimen interactions ($P > 0.13$) were observed for growth performance during any of the dietary phases or for the overall trial (Table 3).

From d 0 to 64, ADG did not differ ($P > 0.27$) among pigs fed different diet forms (Table 4). Pigs fed meal diets had increased ($P < 0.02$) ADFI and poorer ($P < 0.001$) F/G than pigs fed pelleted diets. Fiber level did not influence ADG ($P > 0.64$); however, pigs fed low-fiber diets from d 0 to 64 had decreased ($P < 0.01$) ADFI and improved ($P < 0.001$) F/G compared with pigs fed high-fiber diets during this period (Table 5).

From d 64 to 81, pigs fed pelleted diets had increased ($P < 0.005$) ADG and tended to have increased ($P < 0.10$) ADFI compared with pigs fed meal diets. Feeding pelleted diets also tended to improve ($P < 0.06$) F/G. Pigs previously fed high-fiber diets, then switched to low-fiber diets during this phase, had increased ($P < 0.03$) ADG compared with pigs maintained on the high-fiber diets. Pigs fed the low-fiber diets throughout the trial had intermediate ADG. Pigs previously fed high-fiber diets and switched to the low-fiber diet had increased ($P < 0.001$) ADFI compared with pigs fed low-fiber or high-fiber diets throughout. Pigs fed low-fiber diets throughout the trial had improved ($P < 0.02$) F/G compared with pigs fed high-fiber diets throughout, and pigs that were withdrawn from the high-fiber diet were intermediate.

Overall (d 0 to 81), pigs fed pelleted diets had increased ($P < 0.03$) ADG and improved ($P < 0.001$) F/G compared with pigs fed meal diets. There was no difference ($P > 0.12$) in ADFI between pigs fed the different diet forms. Pigs fed pelleted diets tended ($P < 0.08$) to have increased final BW and HCW compared with pigs fed meal diets, but carcass yield did not differ ($P > 0.28$). Fiber regimen did not influence ($P > 0.35$) ADG for the overall trial, but pigs fed low fiber throughout the trial had increased ($P < 0.001$) ADFI and improved ($P < 0.001$) F/G compared with pigs on the high-fiber withdrawal or pigs fed high fiber throughout. Fiber regimen did not affect ($P > 0.11$) final BW or HCW, but pigs fed high fiber throughout the trial had decreased ($P < 0.001$) carcass yield compared with pigs fed the other fiber regimens. These results are similar to those of Asmus et al. (2011[4]), where removing high-fiber ingredients (DDGS and wheat midds) from the diet before harvest improved carcass yield and returned carcass weights to values similar to control pigs fed corn-soybean meal–based diets throughout the trial.

Belly fatty acid composition. Interactive effects between diet form and fiber regimen were detected ($P < 0.05$) for palmitic (C16:0) and linoleic (C18:2n6c) acid concentrations (Table 6). These were caused by a greater magnitude of change in fatty acid concentrations between pellet and meal diets when the diet contained high fiber than when the diet was low in fiber. Pelleting diets appeared to worsen the impact on belly fat IV of the high oil content in DDGS. Palmitic and total C18:2 fatty acids account for the greatest portions of SFA and PUFA, respectively. As a result, interactions were also detected ($P < 0.01$) for total SFA, total PUFA, UFA:SFA, PUFA:SFA ratios, and belly fat IV.

Pelleting diets reduced ($P < 0.001$) myristic (C14:0), palmitic (C16:0), palmitoleic (C16:1), margaric (C17:0), oleic (C18:1n9c), and vaccenic (C18:1n7) fatty acids; however, pelleting increased ($P < 0.001$) linoleic (C18:2n6c), α-linolenic (C18:3n3), eicosadienoic (C20:2), and total C18:2 fatty acids (Table 7). As a result, total PUFA and belly fat IV increased ($P < 0.001$), whereas total SFA, MUFA, and all other fatty acids decreased ($P < 0.001$) when pigs were fed pelleted diets. There were no differences ($P > 0.15$) in stearic (C18:0), arachidic (20:0), eicosenoic (20:1), or arachidonic (C20:4n6) fatty acids between pigs fed the different diet forms. The greater belly fat IV pigs fed pelleted diets was unexpected, particularly because faster-growing pigs will have a lower IV than slower-growing pigs. Lo Fiego et al. (2005[5]) reported that pigs with heavier BW and HCW had decreased PUFA and IV compared with lighter pigs. To our knowledge, the current trial is the first report of fatty acid change due to diet form. Additional research should be conducted to further investigate the effects of pelleting on fatty acid profile of finishing pigs.

[4] Asmus et al., Swine Day 2011, Report of Progress 1056, pp. 202–215.
[5] Lo Fiego D. P., Santero P., Macchioni P., De Leonibus E. 2005. Influence of genetic type, live weight at harvest and carcass fatness on fatty acid composition of subcutaneous adipose tissue of raw ham in the heavy pig. Meat Sci. 69:107–114.

Compared with pigs fed high fiber throughout the trial, pigs fed low fiber throughout the trial had increased ($P < 0.001$) C16:0, C18:0, C18:1n9c, C18:1n7, total SFA, and total MUFA concentrations, with those fed the withdrawal regimen intermediate ($P < 0.001$) (Table 8). Pigs fed the low-fiber diet had decreased ($P < 0.001$) C18:2n6C, C18:3n3, C20:2, C20:4n6, total C18:2, PUFA, and belly fat IV than those fed high fiber, with those on the withdrawal regiment intermediate ($P < 0.001$). These changes in fatty acid profile, specifically decreases in total PUFA and IV, suggest that withdrawing fiber (from DDGS and wheat midds) from the diet before harvest allowed for improved fat quality compared with feeding high fiber; however, this approach did not return fatty acid concentrations to pigs fed low fiber throughout. Notably, withdrawing fiber sources also reduced the intake of PUFA provided in the diet; thus, the decrease in belly IV value is most likely related to PUFA intake rather than a direct effect of the fiber on PUFA profile.

Regardless of withdrawal, pigs fed higher-fiber diets during any period of the experiment had decreased ($P < 0.001$) C14:0 and C16:1 concentrations and increased ($P < 0.001$) C17:0 concentrations compared with pigs fed low fiber for the entire trial. Feeding high-fiber diets throughout the experiment decreased ($P < 0.001$) C20:0 concentrations compared with the other two regimens, indicating that withdrawing fiber allowed C20:0 concentrations to return to a level similar to that of pigs fed low fiber throughout. No differences ($P > 0.36$) were detected in C20:1 among pigs fed the different fiber regimens. The response to belly fat IV in the current trial is in agreement with past research[4], where withdrawing fiber from the diet allowed for intermediate improvements in carcass fat IV. As expected, Asmus et al. (2011[6]) found that the DDGS component of the high-fiber diet caused the greatest increase in IV, with a smaller increase due to the wheat midds. The high oil content in DDGS has consistently been shown to increase IV of fat stores. Withdrawing high-oil ingredients such as DDGS before harvest appears to be an effective strategy to lowering carcasss fat IV in finishing pigs.

In summary, pelleting the diets improved ADG and F/G, but for unknown reasons increased the amount of unsaturated fatty acids in the belly, resulting in higher IV than pigs fed meal diets. This increase in belly fat IV was greater when the high-fiber diets were fed than when the corn-soybean meal diet was fed, but due to the higher level of unsaturated fatty acids in the high-fiber ingredients used. Compared with pigs fed low-fiber diets throughout, feeding high-fiber diets increased ADFI and resulted in poorer F/G, regardless of withdrawal. Consistent with previous research, high-fiber withdrawal allowed pigs to recover fully the losses in carcass yield associated with feeding high fiber levels, but only an intermediate improvement in belly fat IV was observed.

[6] Asmus et al., Swine Day 2011, Report of Progress 1056, pp. 216–226.

Table 1. Diet composition (as-fed basis)

	Phase 1[1]		Phase 2[2]		Phase 3[3]		Phase 4[4]	
Item Fiber level:[5]	Low	High	Low	High	Low	High	Low	High
Ingredient, %								
Corn	73.71	34.88	78.93	39.99	82.65	43.56	84.97	45.79
Soybean meal (46.5% CP)	23.80	13.74	18.84	8.71	15.32	5.20	13.15	3.04
Dried distillers grains with solubles	---	30.00	---	30.00	---	30.00	---	30.00
Wheat middlings	---	19.00	---	19.00	---	19.00	---	19.00
Monocalcium phosphate (21% P)	0.45	---	0.35	---	0.25	---	0.20	---
Limestone	1.05	1.30	1.00	1.28	0.98	1.29	0.93	1.28
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Vitamin premix	0.15	0.15	0.13	0.13	0.10	0.10	0.08	0.08
Trace mineral premix	0.15	0.15	0.13	0.13	0.10	0.10	0.08	0.08
L-lysine HCl	0.170	0.310	0.150	0.293	0.135	0.278	0.128	0.270
DL-methionine	0.020	---	---	---	---	---	---	---
L-threonine	0.025	---	0.010	---	---	---	---	---
Phytase[6]	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Calculated analysis								
Standardized ileal digestible (SID) amino acids, %								
Lysine	0.93	0.93	0.79	0.79	0.69	0.69	0.63	0.63
Isoleucine:lysine	69	72	70	74	72	76	73	78
Methionine:lysine	30	34	30	37	32	40	33	43
Met & Cys:lysine	59	70	62	77	66	83	69	88
Threonine:lysine	63	66	63	69	64	72	66	74
Tryptophan:lysine	19	19	19	19	19	19	19	19
Valine:lysine	78	88	81	94	85	99	87	103
Total lysine, %	1.04	1.09	0.89	0.94	0.78	0.83	0.72	0.77
ME, kcal/lb	1,513	1,484	1,516	1,486	1,520	1,487	1,522	1,488
CP, %	17.5	20.8	15.6	18.9	14.3	17.6	13.5	16.7
Ca, %	0.59	0.58	0.53	0.56	0.49	0.55	0.46	0.54
P, %	0.47	0.58	0.42	0.56	0.39	0.55	0.37	0.54
Available P, %	0.27	0.39	0.25	0.38	0.22	0.38	0.21	0.37

[1] Phase 1 diets were fed from d 0 to 15.
[2] Phase 2 diets were fed from d 15 to 40.
[3] Phase 3 diets were fed from d 40 to 64.
[4] Phase 4 diets were fed from d 64 to 81.
[5] Each diet was fed in either meal or pellet form.
[6] Phyzyme 600 (Danisco Animal Nutrition, St. Louis, MO) provided 354 phytase units (FTU)/lb, with a release of 0.11% available P.

Table 2. Analysis of pellet quality

	Fiber level	
Item	Low[1]	High[2]
Standard pellet durability index, %[3]		
Phase 1	91.0	92.7
Phase 2	90.1	96.2
Phase 3	92.9	95.9
Phase 4	94.9	91.4
Modified pellet durability index[4]		
Phase 1	87.9	89.4
Phase 2	86.3	92.7
Phase 3	89.5	93.8
Phase 4	92.4	88.8
Fines, %		
Phase 1	7.6	7.3
Phase 2	9.0	7.4
Phase 3	8.0	8.4
Phase 4	7.9	8.1

[1] Refers to diet with 0% dried distillers grains with solubles (DDGS) and 0% wheat middlings.
[2] Refers to diet with 30% DDGS and 19% wheat middlings.
[3] Pellet durability index was determined using the standard tumbling-box technique.
[4] Procedure was altered by adding 5 hexagonal nuts prior to tumbling.

Table 3. Effects of fiber and diet form on finishing pig growth performance[1]

	Diet form							Probability, $P<$		
Fiber level:	Meal			Pellet						
d 0 to 64:	Low[2]	High[3]	High	Low	High	High		Diet form	Meal vs.	Fiber
d 64 to 81:	Low	Low	High	Low	Low	High	SEM	× fiber	pellet	regimen
d 0 to 64										
ADG, lb	2.10	2.14	2.11	2.15	2.16	2.18	0.047	0.92	0.27	0.64
ADFI, lb	5.45	5.81	5.85	5.31	5.49	5.56	0.120	0.76	0.02	0.01
F/G	2.60	2.72	2.76	2.47	2.55	2.56	0.035	0.52	0.001	0.001
d 64 to 81										
ADG, lb	2.05	2.13	1.93	2.24	2.26	2.13	0.071	0.89	0.005	0.03
ADFI, lb	6.45	7.20	7.09	6.95	7.46	6.96	0.153	0.13	0.10	0.001
F/G	3.17	3.38	3.72	3.11	3.30	3.28	0.121	0.25	0.06	0.02
d 0 to 81										
ADG, lb	2.08	2.13	2.09	2.17	2.18	2.17	0.038	0.83	0.03	0.35
ADFI, lb	5.65	6.10	6.11	5.64	5.89	5.85	0.119	0.57	0.12	0.001
F/G	2.71	2.86	2.94	2.61	2.71	2.70	0.037	0.19	0.001	0.001
BW, lb										
d 0	109.5	108.8	109.8	109.2	110.1	108.6	2.93	0.91	0.97	0.93
d 64	244.6	245.5	245.1	248.1	248.5	247.9	4.12	0.99	0.37	0.88
d 81	279.6	281.7	278.0	287.4	287.0	284.3	4.16	0.94	0.07	0.44
Carcass yield, %	75.1	74.7	74.1	75.0	74.8	73.4	0.24	0.88	0.28	0.001
HCW, lb	210.2	210.4	206.1	215.7	214.9	208.7	3.55	0.13	0.08	0.11

[1] A total of 288 pigs (PIC 327 × 1050, initially 109.3 lb BW) were used in an 81-d trial to determine the effects of diet form and lowering fiber levels prior to marketing on growth performance of growing-finishing pigs.
[2] Refers to diet with 0% dried distillers grains with solubles (DDGS) and 0% wheat middlings.
[3] Refers to diet with 30% DDGS and 19% wheat middlings.

Table 4. Main effects of diet form on finishing pig growth performance

	Diet form			
	Meal	Pellet	SEM	Probability, *P*<
d 0 to 64				
ADG, lb	2.12	2.16	0.027	0.27
ADFI, lb	5.70	5.45	0.069	0.02
F/G	2.69	2.53	0.020	0.001
d 64 to 81				
ADG, lb	2.04	2.21	0.041	0.005
ADFI, lb	6.91	7.12	0.088	0.10
F/G	3.43	3.23	0.070	0.06
d 0 to 81				
ADG, lb	2.10	2.17	0.022	0.03
ADFI, lb	5.95	5.80	0.069	0.12
F/G	2.83	2.67	0.021	0.001
BW, lb				
d 0	109.4	109.3	1.69	0.97
d 64	245.1	248.1	2.38	0.37
d 81	279.7	286.2	2.40	0.07
Carcass yield, %	74.6	74.4	0.14	0.28
HCW, lb	208.9	213.1	1.70	0.08

[1] A total of 288 pigs (PIC 327 × 1050, initially 109.3 lb BW) were used in an 81-d trial to determine the effects of diet form and lowering fiber levels prior to marketing on growth performance of growing-finishing pigs.

Table 5. Main effects of fiber on finishing pig growth performance

	Fiber level				
d 0 to 64:	Low	High	High		
d 64 to 81:	Low	Low	High	SEM	Probability, $P<$
d 0 to 64					
ADG, lb	2.13	2.15	2.14	0.033	0.64
ADFI, lb	5.38[a]	5.65[b]	5.70[b]	0.085	0.01
F/G	2.53[a]	2.63[b]	2.66[b]	0.025	0.001
d 64 to 81					
ADG, lb	2.14[ab]	2.20[a]	2.03[b]	0.050	0.03
ADFI, lb	6.70[b]	7.33[a]	7.02[b]	0.108	0.001
F/G	3.14[a]	3.34[ab]	3.50[b]	0.085	0.02
d 0 to 81					
ADG, lb	2.13	2.16	2.12	0.027	0.35
ADFI, lb	5.65[a]	6.00[b]	5.98[b]	0.084	0.001
F/G	2.66[a]	2.78[b]	2.82[b]	0.026	0.001
BW, lb					
d 0	109.4	109.5	109.2	2.07	0.93
d 64	246.4	247.0	246.5	2.91	0.88
d 81	283.5	284.3	281.1	2.94	0.65
Carcass yield, %	75.1[a]	74.8[a]	73.7[b]	0.17	0.001
HCW, lb	213.0	212.6	207.4	2.06	0.11

[a,b] Means with different superscripts differ significantly, $P < 0.05$.
[1] A total of 288 pigs (PIC 327 × 1050, initially 109.3 lb BW) were used in an 81-d trial to determine the effects of diet form and lowering fiber levels prior to marketing on growth performance of growing-finishing pigs.
[2] Refers to diet with 0% dried distillers grains with solubles (DDGS) and 0% wheat middlings.
[3] Refers to diet with 30% DDGS and 19% wheat middlings.

Table 6. Effects of fiber and diet form on finishing pig belly fat fatty acid profile[1]

	Diet form							Probability, *P*<		
Fiber level:	Meal			Pellet						
d 0 to 64:	Low[2]	High[3]	High	Low	High	High		Diet form	Meal vs.	Fiber
Item d 64 to 81:	Low	Low	High	Low	Low	High	SEM	× fiber	pellet	regimen
Myristic acid (C14:0), %	1.47	1.39	1.36	1.44	1.31	1.29	0.018	0.59	0.001	0.001
Palmitic acid (C16:0), %	23.91	22.49	21.87	23.68	21.67	21.04	0.130	0.05	0.001	0.001
Palmitoleic acid (C16:1), %	3.30	3.06	2.96	3.03	2.66	2.62	0.061	0.81	0.001	0.001
Margaric acid (C17:0), %	0.35	0.39	0.43	0.33	0.36	0.38	0.014	0.45	0.002	0.001
Stearic acid (C18:0), %	10.61	9.44	8.94	10.79	9.21	8.64	0.114	0.07	0.19	0.001
Oleic acid (C18:1n9c), %	39.45	37.84	36.73	38.71	36.59	35.73	0.214	0.65	0.001	0.001
Vaccenic acid (C18:1n7), %	4.27	3.95	3.76	4.02	3.57	3.47	0.051	0.87	0.001	0.001
Linoleic acid (C18:2n6c), %	12.89	17.22	19.57	14.25	20.38	22.51	0.290	0.01	0.001	0.001
Total C18:2 fatty acids, %[4]	13.05	17.41	19.75	14.38	20.52	22.64	0.290	0.01	0.001	0.001
α-Linolenic acid (C18:3n3), %	0.58	0.68	0.74	0.63	0.80	0.84	0.014	0.16	0.001	0.001
Arachidic acid (C20:0), %	0.22	0.22	0.21	0.23	0.22	0.21	0.004	0.53	0.57	0.001
Eicosenoic acid (C20:1), %	0.65	0.67	0.66	0.67	0.66	0.63	0.015	0.33	0.58	0.36
Eicosadienoic acid (C20:2), %	0.59	0.78	0.85	0.65	0.90	0.95	0.012	0.15	0.001	0.001
Arachidonic acid (C20:4n6), %	0.25	0.29	0.30	0.24	0.28	0.29	0.006	0.84	0.15	0.001
Other fatty acids, %	1.30	1.42	1.46	1.22	1.26	1.29	0.018	0.05	0.001	0.001
Total SFA, %[5]	36.94	34.29	33.18	36.82	33.12	31.90	0.208	0.01	0.001	0.001
Total MUFA, %[6]	48.25	46.16	44.76	46.95	43.99	42.96	0.286	0.56	0.001	0.001
Total PUFA, %[7]	14.80	19.55	22.06	16.23	22.89	25.15	0.318	0.02	0.001	0.001
UFA:SFA, ratio[8]	1.71	1.92	2.02	1.72	2.03	2.14	0.018	0.01	0.001	0.001
PUFA:SFA, ratio[9]	0.40	0.57	0.67	0.44	0.69	0.79	0.012	0.001	0.001	0.001
Iodine value[10]	65.7	71.7	74.7	67.0	75.5	78.4	0.378	0.003	0.001	0.001

[1] All items calculated as a percentage of the total fatty acid content.
[2] Refers to diet with 0% dried distillers grains with solubles (DDGS) and 0% wheat middlings.
[3] Refers to diet with 30% DDGS and 19% wheat middlings.
[4] Total C18:2 fatty acids = [% C18:2n6t] + [% C18:2n6c] + [% C18:2, 9c11t] + [% 18:2, 10t12c] + [% C18:2, 9c11c] + [C18:2, 9t11t].
[5] Total SFA = [% C10:0] + [% C11:0] + [% C12:0] + [% C14:0] + [% C15:0] + [% C16:0] + [% C17:0] + [% C18:0] + [% C20:0] + [% C21:0] + [% C22:0] + [% C 24:0].
[6] Total MFA = [% C14:1] + [% C15:1] + [% C16:1] + [% C17:1] + [% C18:1n9t] + [% C18:1n9c] + [% C18:1n7] + [% C20:1] + [% C24:1].
[7] Total PUFA = [% C18:2n6t] + [% C18:2n6c] + [% C18:2 9c,11t] + [% C18:2 10t,12c] + [% C18:2 9c,11c] + [% C18:2 9t,11t] + [% C18:3n6] + [% C18:3n3] + [% C20:2] + [% C20:3n6] + [% C20:4n6] + [% C20:5n3] + [% C22:5n3] + [% C22:5n6].
[8] UFA:SFA ratio = [total MUFA + total PUFA] / total SFA.
[9] PUFA:SFA ratio = total PUFA / total SFA.
[10] Iodine value = [% C16:1] × 0.95 + [% C18:1] × 0.86 + [% C18:2] × 1.732 + [% C18:3] × 2.616 + [% C20:1] × 0.785 + [% C22:1] × 0.723.

Table 7. Main effects of diet form on finishing pig fatty acid profile[1]

	Diet form			
Item	Meal	Pellet	SEM	Probability, *P*<
Myristic acid (C14:0), %	1.39	1.33	0.016	0.001
Palmitic acid (C16:0), %	22.64	22.01	0.112	0.001
Palmitoleic acid (C16:1), %	3.03	2.69	0.054	0.001
Margaric acid (C17:0), %	0.39	0.36	0.009	0.001
Stearic acid (C18:0), %	9.66	9.54	0.065	0.19
Oleic acid (C18:1n9c), %	37.84	36.84	0.180	0.001
Vaccenic acid (C18:1n7), %	3.88	3.57	0.047	0.001
Linoleic acid (C18:2n6c), %	17.09	19.60	0.268	0.001
Total C18:2 fatty acids, %[2]	17.26	19.73	0.267	0.001
α-Linolenic acid (C18:3n3), %	0.70	0.79	0.013	0.001
Arachidic acid (C20:0), %	0.22	0.22	0.002	0.57
Eicosenoic acid (C20:1), %	0.66	0.65	0.008	0.58
Eicosadienoic acid (C20:2), %	0.77	0.86	0.012	0.001
Arachidonic acid (C20:4n6), %	0.28	0.27	0.005	0.15
Other fatty acids, %	1.39	1.25	0.010	0.001
Total SFA, %[3]	34.72	33.85	0.160	0.001
Total MUFA, %[4]	46.00	44.24	0.258	0.001
Total PUFA, %[5]	19.42	22.05	0.294	0.001
UFA:SFA, ratio[6]	1.90	1.97	0.014	0.001
PUFA:SFA, ratio[7]	0.57	0.67	0.011	0.001
Iodine value[8]	71.3	74.3	0.346	0.001

[1] All items calculated as a percentage of the total fatty acid content.
[2] Total C18:2 fatty acids = [% C18:2n6t] + [% C18:2n6c] + [% C18:2, 9c11t] + [% 18:2, 10t12c] + [% C18:2, 9c11c] + [C18:2, 9t11t].
[3] Total SFA = [% C10:0] + [% C11:0] + [% C12:0] + [% C14:0] + [% C15:0] + [% C16:0] + [% C17:0] + [% C18:0] + [% C20:0] + [% C21:0] + [% C22:0] + [% C 24:0].
[4] Total MUFA = [% C14:1] + [% C15:1] + [% C16:1] + [% C17:1] + [% C18:1n9t] + [% C18:1n9c] + [% C18:1n7] + [% C20:1] + [% C24:1].
[5] Total PUFA = [% C18:2n6t] + [% C18:2n6c] + [% C18:2 9c,11t] + [% C18:2 10t,12c] + [% C18:2 9c,11c] + [% C18:2 9t,11t] + [% C18:3n6] + [% C18:3n3] + [% C20:2] + [% C20:3n6] + [% C20:4n6] + [% C20:5n3] + [% C22:5n3] + [% C22:5n6].
[6] UFA:SFA ratio = [total MUFA + total PUFA] / total SFA.
[7] PUFA:SFA ratio = total PUFA / total SFA.
[8] Iodine value = [% C16:1] × 0.95 + [% C18:1] × 0.86 + [% C18:2] × 1.732 + [% C18:3] × 2.616 + [% C20:1] × 0.785 + [% C22:1] × 0.723.

Table 8. Main effects of diet regimen on finishing pig fatty acid profile[1]

		Fiber level				
	d 0 to 64:	Low[2]	High[3]	High		
Item	d 64 to 81:	Low	Low	High	SEM	Probability, $P<$
Myristic acid (C14:0), %		1.44[a]	1.33[b]	1.31[b]	0.018	0.001
Palmitic acid (C16:0), %		23.67[a]	21.95[b]	21.36[c]	0.127	0.001
Palmitoleic acid (C16:1), %		3.09[a]	2.78[b]	2.73[b]	0.062	0.001
Margaric acid (C17:0), %		0.34[a]	0.38[b]	0.40[b]	0.010	0.001
Stearic acid (C18:0), %		10.70[a]	9.32[b]	8.79[c]	0.078	0.001
Oleic acid (C18:1n9c), %		38.91[a]	37.03[b]	36.09[c]	0.206	0.001
Vaccenic acid (C18:1n7), %		4.03[a]	3.64[b]	3.52[c]	0.054	0.001
Linoleic acid (C18:2n6c), %		14.14[a]	19.40[b]	21.50[c]	0.303	0.001
Total C18:2 fatty acids, %[4]		14.28[a]	19.56[b]	21.65[c]	0.303	0.001
α-Linolenic acid (C18:3n3), %		0.64[a]	0.77[b]	0.82[c]	0.014	0.001
Arachidic acid (C20:0), %		0.22[a]	0.22[a]	0.21[b]	0.003	0.001
Eicosenoic acid (C20:1), %		0.66	0.66	0.64	0.010	0.36
Eicosadienoic acid (C20:2), %		0.65[a]	0.87[b]	0.93[c]	0.013	0.001
Arachidonic acid (C20:4n6), %		0.25[a]	0.29[b]	0.30[c]	0.006	0.001
Other fatty acids, %		1.26[a]	1.34[b]	1.37[b]	0.013	0.001
Total SFA, %[5]		36.79[a]	33.60[b]	32.46[c]	0.185	0.001
Total MUFA, %[6]		47.19[a]	44.64[b]	43.53[c]	0.293	0.001
Total PUFA, %[7]		16.17[a]	21.91[b]	24.13[c]	0.333	0.001
UFA:SFA, ratio[8]		1.73[a]	1.99[b]	2.09[c]	0.017	0.001
PUFA:SFA, ratio[9]		0.45[a]	0.66[b]	0.75[c]	0.012	0.001
Iodine value (IV)[10]		67.0[a]	74.3[b]	77.1[c]	0.393	0.001

[1] All items calculated as a percentage of the total fatty acid content.

[2] Refers to diet with 0% dried distillers grains with solubles (DDGS) and 0% wheat middlings.

[3] Refers to diet with 30% DDGS and 19% wheat middlings.

[4] Total C18:2 fatty acids = [% C18:2n6t] + [% C18:2n6c] + [% C18:2, 9c11t] + [% 18:2, 10t12c] + [% C18:2, 9c11c] + [C18:2, 9t11t].

[5] Total SFA = [% C10:0] + [% C11:0] + [% C12:0] + [% C14:0] + [% C15:0] + [% C16:0] + [% C17:0] + [% C18:0] + [% C20:0] + [% C21:0] + [% C22:0] + [% C 24:0].

[6] Total MUFA = [% C14:1] + [% C15:1] + [% C16:1] + [% C17:1] + [% C18:1n9t] + [% C18:1n9c] + [% C18:1n7] + [% C20:1] + [% C24:1].

[7] Total PUFA = [% C18:2n6t] + [% C18:2n6c] + [% C18:2 9c,11t] + [% C18:2 10t,12c] + [% C18:2 9c,11c] + [% C18:2 9t,11t] + [% C18:3n6] + [% C18:3n3] + [% C20:2] + [% C20:3n6] + [% C20:4n6] + [% C20:5n3] + [% C22:5n3] + [% C22:5n6].

[8] UFA:SFA ratio = [total MUFA + total PUFA] / Total SFA.

[9] PUFA:SFA ratio = total PUFA / total SFA.

[10] Iodine value = [% C16:1] × 0.95 + [% C18:1] × 0.86 + [% C18:2] × 1.732 + [% C18:3] × 2.616 + [% C20:1] × 0.785 + [% C22:1] × 0.723.